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(54) **Passenger aircraft emergency breathing system**

(57) An aircraft emergency breathing system enables cabin conditioning/pressurising air, in reduced volume, to be delivered to every occupant by way of a mask, to prevent inspiration of contaminated air from the cabin in the event of a fire

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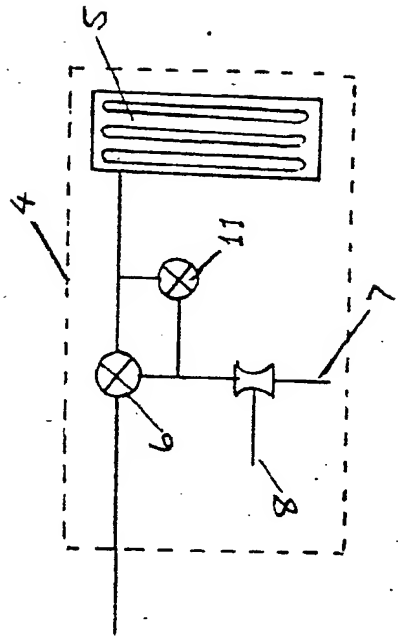

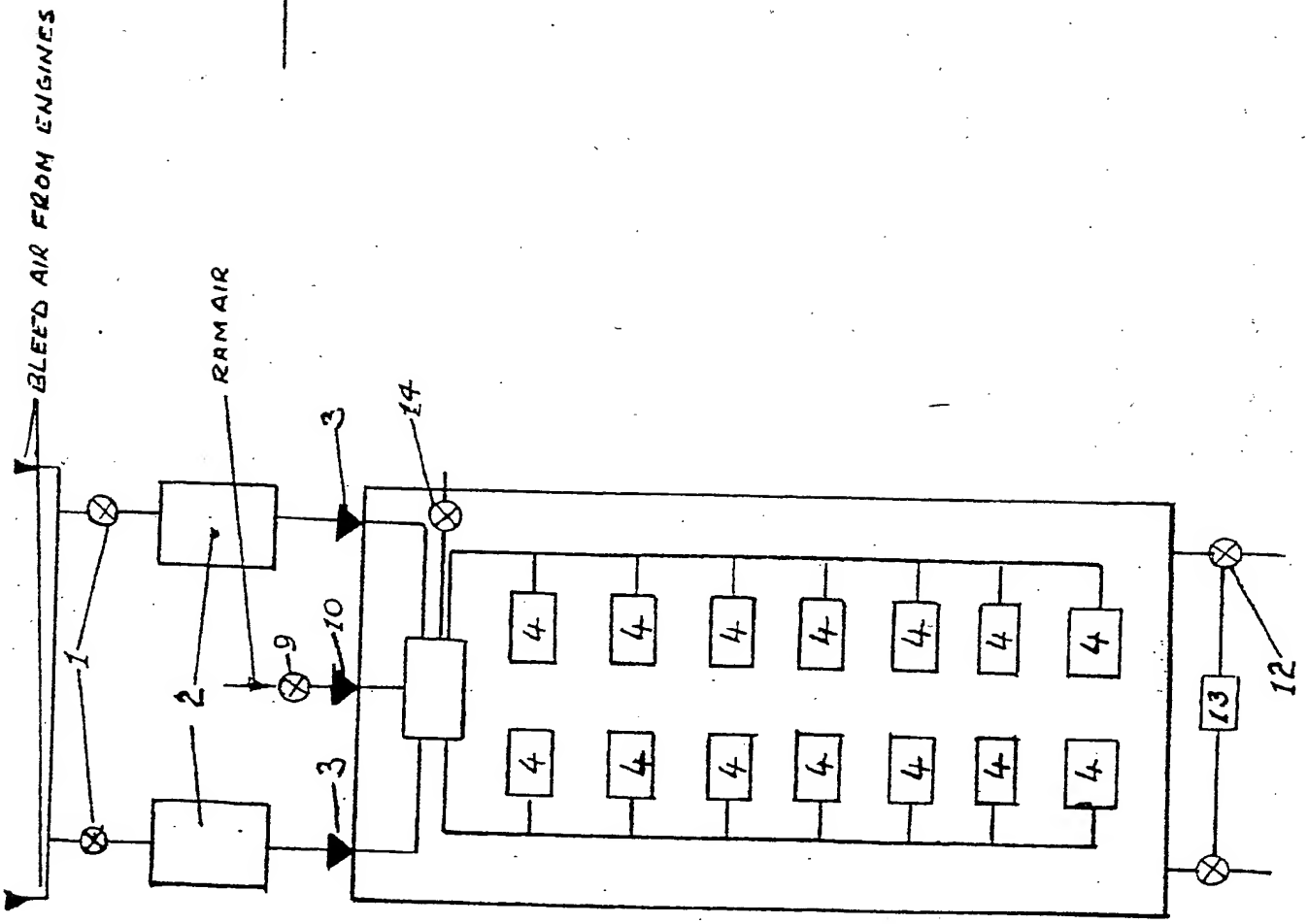

SPECIFICATION

Passenger aircraft emergency breathing system

I, Karl Wingett Smith, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an emergency breathing system for use by passengers in aircraft.

For physiological reasons, high altitude flight requires passenger compartments to be maintained at internal pressures greater than atmospheric when the aircraft is higher than approximately 8000 feet above mean sea level. For this purpose air is customarily drawn from the propulsion engines and, after pressure and temperature have been suitably regulated, is delivered to the cabin. The pressure within the cabin is controlled by valves exhausting this air to the external atmosphere. Protection against oxygen deficiency resulting from accidental loss of cabin pressure is afforded by the provision of emergency oxygen supplies fed to face masks. This supply is of short endurance, intended to enrich the cabin air inhaled through the mask to an oxygen concentration in the lungs sufficient to maintain consciousness whilst the aircraft descends to a lower altitude where the atmosphere can sustain life without added oxygen.

Fire in the air has led to a number of passenger fatalities from the inhalation of lethal products of combustion. These gases have been identified as originating in materials used in cabin furnishings, in the fire retardant additives used in some of these materials and in fire extinguishers, and in hydraulic fluids. Their presence in the cabin atmosphere renders that atmospheric toxic, and even the use of emergency oxygen, depending as it does on the principle of enriching cabin atmosphere, does not combat incapacity and death.

This invention provides for the delivery of conditioned air to a hood or mask at sufficient flow rate and pressure to exclude the contaminated cabin atmosphere. The minimum lung ventilation rate being less than that specified for cabin space ventilation, the total air delivery may be reduced so that ventilation of the fire is minimal. When the emergency is complicated by the combination of fire and reduced cabin pressure, life can be preserved by enriching the mask/hood air supply in the normal way with oxygen from either a ring main system or individual candle generators.

In this invention, passenger service units comprising cabin air inlet grilles, diverter valves, mask/hood assembly storage and connection, also, when appropriate, oxygen containers for high altitude emergency and for ground level evacuation, are installed at convenient locations in the aircraft. As in current practice, these are typically in two, three or four person multiple units to suit the requirements of specific seat rows.

In ordinary use the aircraft air conditioning systems, duplicated as a safeguard against single failure, deliver fresh air to the cabin. Detection of fire or smoke results in the triggered release of the passenger service unit covers; this action in turn leads to simultaneous mask/hood presentation and diversion of the air supply from the normal grille to the mask assembly. Air flow reduction, which will both enhance the comfort of the wearer and aid fire suppression can be achieved by either shutdown of the air conditioning system in part by means of existing controls or by diverting part overboard through an additional cabin by-pass valve. The only essential modifications to existing aircraft installations, beyond the incorporation of these passenger service units, are those necessary to upgrade the fire resistance of cabin air distribution ducting.

The advantages lie in the extended use of existing technology and aircraft systems in preserving life.

While existing installation and new designs inevitably differ in detail, the overall principles are the same for all. Fig. 1 shows, in diagram form, a typical layout.

Referring to the drawing, air from the engines is fed, via isolating valves 1, to air conditioning packs 2. This air enters the cabin distribution system through pressure bulkhead non-return valves 3 and is normally delivered to the supply grilles 5.

As indicated earlier, detection of fire, smoke or loss of cabin pressure results in actuation of valve 6 which diverts air from grilles 5 to the mask/hood supply hose 7. Should cabin altitude be too great, oxygen connections 8 enable enrichment from any appropriate source.

At standard pressure and temperature the average breathing intake is 15 litres of free air per minute per person. The quantity normally delivered to an aircraft cabin is currently 1 lb per minute, i.e. approximately 360 litres per minute per person; this will be reduced to some 145 litres per minute when new aircraft enter service. Incorporated within the hood outlet from the passenger service unit is a flow limiter (14) restricting air supply to that needed for breathing. Excess air is vented to the cabin by a pressure relief valve (11) incorporated in the passenger service unit. To assist fire control this excess flow may be reduced by close down of one or more air conditioning pack isolation valves 1 (according to the number and sizing of the packs used in specific aircraft types).

To afford maximum protection against total air conditioning system failure or contamina-

tion, an additional ram air supply can be incorporated and initiated by operation of emergency ram valve 9. Reverse flow is precluded by non-return valve 10.

1 Air Conditioning Pack Isolating Valve
2 Air Conditioning Pack
3 Non-Return Valve
4 Passenger Service Unit
5 Air Delivery Grille
6 Air Diverter Valve
7 Mask/Hood Supply Connection
8 Oxygen System Connection
9 Emergency Ram Air Valve (Optional)
10 Non-Return Valve (Optional)
11 Pressure Relief Valve
12 Cabin Discharge Valve
13 Cabin Pressure Controller

CLAIMS

1. An aircraft emergency breathing system which enables cabin air conditioning/pressurising air, in reduced volume, to be delivered to every occupant by way of a combined mask and hood assembly prevents inspiration of contaminated air from the cabin in the event of fire. The hood functions as a breathing air and oxygen economiser, it further serves the following purposes:–

2. Protection from anoxia by oxygen enrichment.

3. Protection from the combination of toxicity and anoxia.

4. An evacuation breathing system when a self-contained air or oxygen source is connected to the mask supply hose and activated when the hose is detached from the aircraft supply.

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